PUMP AND WELL SYSTEM

HANDBOOK

VALE DISTRICT

Prepared by

Deane Mahan, Supervisory Range Technician

Distributed by
United States Department of the Interior
Bureau of Land Management
Oregon-Washington State Office

INFORMATION BOOKLET PREPARED FOR THE CONSTRUCTION OF A WELL INSTALLATION

PREPARED BY DEANE MAHAN, SUPVISORY RANGE TECHNICIAN,
VALE, OREGON FOR THE BUREAU OF LAND MANGEMENT

To simplify information, trade names have been used in this handbook. No endorsement of named products is intended nor is criticism implied of similar products which are not mentioned.

FOREWORD

PURPOSE OF THIS BOOKLET IS TO HELP PLAN AN EXTENSIVE WELL SYSTEM, USING IN GENERAL, VARIOUS FACTORS INSTRUMENTAL TO THE PLANNING OF ONE.

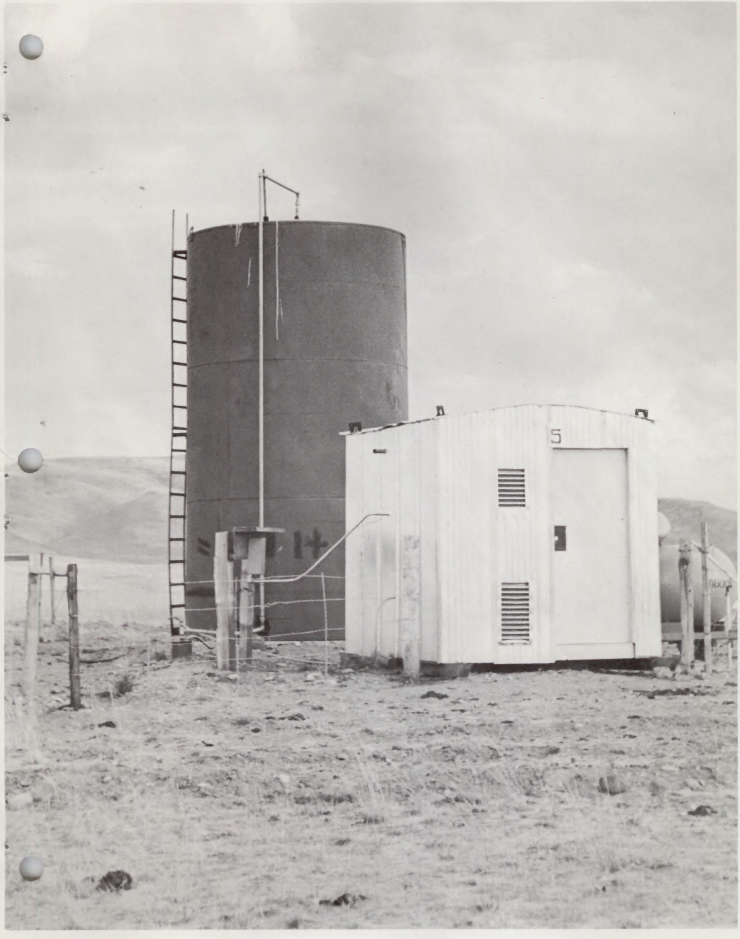
NO ATTEMPT IS INTENDED TO SPECIFY ANY PARTICULAR WELL SYSTEM BUT TO USE ESSENTIAL PORTIONS OF ESTABLISH ONES TO HELP OTHERS TO PLAN.

THIS BOOKLET MAY HELP OUR OWN PERSONNEL IN THEIR OWN PLANNING AND EXECUTION OF SAME.

COMPILED AS OF MAY 25, 1966, FROM DATA USED IN AND BY THE VALE GRAZING DISTRICT, NO. 3, OREGON.

PRICES SHOWN IN THIS BOOKLET ARE QUOTED FROM INFORMATION USED THROUGH THE FISCAL YEAR 1966.

CONTENTS


5

WELL INSTALLATION

This photo shows a typical well installation on the range near Jordan Valley, Oregon.

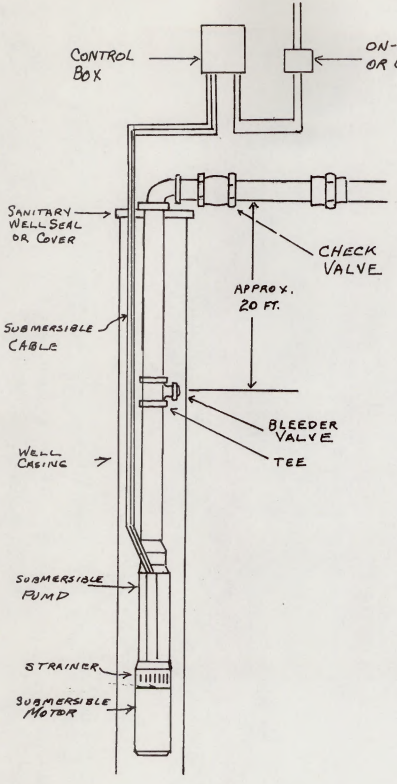
A well is shown with a sanitary cap; pipe leading from it to the tank, up and into the top.

A pump control center at the well with a conduit leading from it to the well top and to the generator house on the right.

The generator house is of frame construction. Built on skids to move into place whenever needed and with lift irons at the top to enable it to be picked up by a crane whenever possible. The lift irons have steel rods which run down at each corner into and tied to each skid.

On the right of the building the 1,000 gallon L.P. Gas is shown.

A barbed wire fence, with a gate at the right of the building, is shown; this is to protect the installation from cattle rubbing and breaking essential items. Ventilators are shown in building to left of door. Ventilators are in front also to let freedom of cool outside air to circulate. Later houses have screen side openings which let the escape of hot air rising to the ceiling.



PUMP & WATER SYSTEMS
SUBMERSIBLE PUMP
5/25/66 DWM.

SUBMERSIBLE PUMP

A submersible pump is similar to the turbine with impellars or stages. With a turbine the power is from the surface of the ground where the motor is located; with a turbine submersible the motor is located at the bottom of the well with the pump above it pushing the water to the surface making it easier and requires less power.

The submersibles come normally in two sizes, a four (4) inch, and a six (6) inch. It is powered principally with a "Franklin" 4 or 6 inch motor; but in some cases there will be found an "U.S." motor.

The pump referred to in this booklet are principally a four (4) inch diameter submersible type which should be pruchased basically with a 4 inch pump control box and a splicing kit. However, it will be found that companies some times do not furnish the above as a kit unit, so that the control box may have to be purchased separately. Be sure that this box matches the requirements of the pump motor, as the manufacturer recommends or requires.

It is well that uniformity of pumps, motors, control boxes, etc. be maintained. This will simplify the ordering of parts for maintenance.

The control box should be as simple as possible, equipped with a starting capacitator, starting relay and an automatic over-load protection. These units should be of the "plug-in" type which makes replacement quick and easy.

Each unit should be equipped with a lightening arrester, (one arrester for 1 single phase and 2 lightening arresters for 3 phase).

The submersible pump should always be tested just previous to installation. Wires should be tested and checked for proper placement and connection to the control box and as well to the pump.

The cable after splicing to the pump leads should be carefully placed against the pump and fasten with careful placed cable fasteners, to prevent abrasive or cutting action, and then fasten not more than 20 feet of cable at a time. Regular cable fasteners can be secured consisting of 18" length of number 10 Thermo-plastic wire for fastening, and a rubber pad for the cable protection. This pad can be furnished for the various sizes of cable. Or stainless steel clamps may be substituted for the above wire clamp. This unit should consist of a cast saddle guard, rubber pad, and "Band-1T" stainless steel strap 3/8" wide.

Sanitary well seals are a must requirement for a well. A submersible type can be secured for various well sizes from 4 to 8 inches in diameter. The seal will allow the pipe column, and the cable to the well and if an air vent is necessary will have an opening for it.

PRICE SCHEDULE

FOR

DEEP WELL SUBMERSIBLE PUMPS

Pumps quoted here are in accordance with a government open contract, with the following conditions and specifications. (F.Y. 1966)

Description

Deep well submersible pumps in accordance with specifications that follows, complete with electric motor and accessories and with minimum pacacities indicated below based on zero discharge pressure.

Item No.	HP Rat.	V., Freq. & Phase	GPH Cap.	Lift Cap.	Unit	FOB Vale, Ore.	FOB (Plant Contractors
1.	1	208/60/3	600	260'	Each	295.79	291.06
2.	2	208/60/3	600	400'	Each	265.56	360.83
3a.	3	208/60/1	600	400'	Each	489.89	480.43
3b.	3	208/60/3	600	500'	Each	418.29	408.83
4a.	5	208/60/1	500	1000'	Each	520.71	511.25
4b.	5	208/60/3	500	1000'	Each	415.89	406.43

(FOR YOUR GUIDANCE & INFORMATION ONLY)

Contractor

Berkeley Pump Company
829 Bancroft Way
Berkeley, California 94710
Phone: (415) 843-9400

(For F.Y. 1966 Only)

SPECIFICATIONS FOR DEEP WELL SUBMERSIBLE PUMP

1. General:

Deep well submersible pump shall consist of an assembly of pump and motor to fit 4" I.D. well casing. Each pump shall be furnished with controls and accessories as herein specified and shall be for operation for 208/60/1 or 208/60/3 power (as specified) supplied by a 120/208/60/3 LP gas-driven generator set. An installation and maintenance manual, including wiring diagrams for motor, control panel and low water cut-off, shall be furnished with each pump.

2. Pump:

Pump shall be built, tested, and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten years and who has parts and service facilities available in the Pacific Northwest. Pump and motor shall be one complete assembly, must be easily serviceable in the field, and shall include a trouble-free check valve. Bowls, bearings, moving parts and intake screen shall be corrosion and abrasion resistant. Pump outlet shall be not less than 1¼" IPT.

3. Motor:

Motor shall be permanently lubricated and American-made to NEMA and ASA standards. Motor leads shall be protected to top of pump assembly. Single-phase motor shall be provided with necessary capacitator(s) and centrifugal or thermal switch.

4. Accessories and Controls:

Each pump shall be provided with a control panel or panels containing a magnetic starter with overload protection, an adjustable pneumatic delay relay to provide 2 minutes delay from energization of power circuit to starter pull-in, 3-pole circuit breaker and OFF-AUTO switch. Magnetic starter and relay coils shall be for operation on, and rated at not less than, 120 volts. Circuit breaker and overload heaters for the magnetic starter shall be precisely selected for full-load operation of the motor at 215 volts. Delay relay shall be similar to Agastat NE-11. A floatless liquid level controller shall be furnished with each pump to limit draw-down of the well. Controller shall be for 120-volt operation and shall be furnished with 2 probes, less cables. All electrical equipment required herein shall be provided with NEMA Type 1 enclosures having suitable knockouts for wiring.

Wiring Installation

The submersible must be connected directly to the control box. The tables are self explanatory in using the correct wire size. If required cable length between two sizes, use the heavier of the two sizes (smaller). Use of wire size smaller than reccommended, or of cable length longer than recommended in the table will void possibly any warranty of the pump.

Voltage at the control box, or starter must not be below the following :

Single-Phase :	105 volts on 115 volt line, or 210 volts on 230 volt line.
Three-Phase :	200 volts on 220 volt line, or 400 volts on 440 volt line.

If it is necessary to set the pressure tank some distance from the well, the pressure switch and electrical controls must be installed at the tank. If the distance is not to great the electrical control box can be installed at the well, and the pressure tank and pressure switch can be installed together. With this arrangement for a sinle-phase only two wire are required from the pressure switch to the control box. If the control box is installed with the tank three (3) wires are required from the control box to the well.

The following tables are helpfull in the selection of wire, the resistance, etc., in correlation with motor rating and phase.

SINGLE-PHASE MOTORS

Maximum Pump Drop Cable Length In Feet

MOTOR RATING		WIRE SIZE							
H.P.	Volts	#14	#12	#10	#8	#6	#4	#2	M#0
1	230	165	260	415	660	1050			
1½	230	130	200	315	500	800	1270		
2	230	95	150	240	380	600	960		
3	230		100	155	245	395	625	990	
5	230			125	195	315	500	790	1250
7½	230				150	240	380	610	970

MAXIMUM SUPPLY LENGTH OF WIRE IN FEET.
(Control Box to load center, or transformer)

MOTOR RATING		WIRE SIZE							
H.P.	Volts	#14	#12	#10	#8	#6	#4	#2	#0
1	230	40	65	105	165	265	420	665	1060
1½	230	30	50	80	125	200	320	505	805
2	230	25	40	60	95	150	240	385	610
3	230		25	40	60	100	160	250	400
5	230			30	50	80	125	200	310
7½	230				40	60	95	155	245

THREE-PHASE MOTORS

MAXIMUM PUMP DROP CABLE LENGTH IN FEET

(MOTOR TO CONTROL BOX OR STARTER)

Motor Rating		Wire Size							
H.P.	Volts	#14	#12	#10	#8	#6	#4	#2	#0
1½	220	695	1100	1750					
2	220	480	760	1210	1930				
3	220	350	550	875	1395	2220			
5	220	225	355	565	900	1430	2280		
7½	220		240	385	615	975	1550	2470	
10	220			280	450	715	1140	1810	2750

MAXIMUM SUPPLY WIRE LENGTH IN FEET

(STARTER OR CONTROL BOX TO LOAD OR TRANSFORMER)

Motor Rating		Wire Size							
H.P.	Volts	#14	#12	#10	#8	#6	#4	#2	#0
1½	220	175	275	435	700	1105	1760		
2	220	120	190	300	480	765	1215		
3	220	85	140	220	350	555	880	1400	
4	220	55	90	140	225	360	570	910	1380
7½	220		60	95	155	255	385	615	980
10	220			70	115	180	285	455	725

OHM DROP PER 1,000 FEET OF WIRE

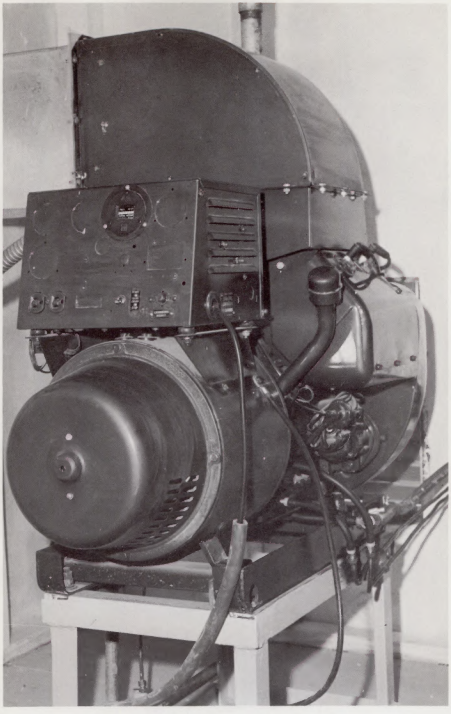
Wire Size	#14	#12	#10	#8	#6	#4	#2	#0
OHMS Per 1,000 Ft.	2.575	1.619	1.018	.641	.396	.248	.156	.0982

Use of smaller wire than shown in the tables will cause low starting voltage and result in early failure of unit.

For use of submersible wire before purchasing it will be well to check with manufacturer of pump cable selection charts for correct size of cable for the pump you buy. Different manufacturers in their warranty require a size that may differ slightly from the other manufacturer of pumps.

Usually submersible cable is water proof material such as rubber bonded-neoprene covered, or thermo-plastic covered.

A VALE TYPICAL GENERATOR BUILDING



A GENERATOR PLANT

ELECTRIC GENERATOR

At the present time we are purchasing with an open end Government contract three types or capacities of electric generator.

Description

Generating set, electric 120/208 volts, 3 phase, L. P. (Liquid Petroleum) gas powered, including accessories.

Item No.	Cap.	Unit	Make	F.O.B. Vale, Ore.	FOB (Plant) Contractor's
1.	3.5 KW	Each	Kohler	$ 698.00*	$ 667.25
2.	7.5 KW	Each	Kohler	$ 992.00*	$ 951.06
3.	10.0 KW	Each	Kohler	$1220.50*	$1172.49

*Prices are under Government contract effective in fiscal year 1966 only, pay terms net.

Contractor

The Instrument Laboratory Co.
1316 South East 7th Avenue
Portland, Oregon 97214

GENERATOR:

The generator shall be rotating armature, direct connected to the engine crankshaft and to include auxiliary field and voltage stabilizer to assure good motor starting characteristics. It shall be drip-proof and rated as required for continuous duty at 3.5 KW, 7.5 KW, and 10 KW, 80% power factor, with inherent voltage regulation of $\pm$5%. Frequency regulation to be within 3 cycles maximum. Cranking protection, locked rotor protection and field circuit breaker shall be provided.

INSTRUMENTS:

A shock-mounted instrument panel shall contain the oil pressure gage, a running time meter (0 to 9999.9 hours), 120 V grounding type duplex receptacle, cranking reset button, the battery charge rate regulator and start and stop switch for manual operation. The control panel shall include a 4-position switch to allow selection of the following operations: Automatic, stop, check and hand crank.

ACCESSORIES:

All accessories needed for the proper operation of the set shall be furnished. These shall include battery cables, emergency starter rope, muffler and exhaust tubing.

The set shall be equipped with a crank-case oil-level regulator and a ten-gallon reserve oil supply tank with float assembly, complete with 3 feet of tubing and all necessary fittings.

The plant shall be mounted on heavy duty shock or anti-vibration mounts.

The set shall be furnished LESS fuel tanks
The set shall be furnished LESS starting batteries.

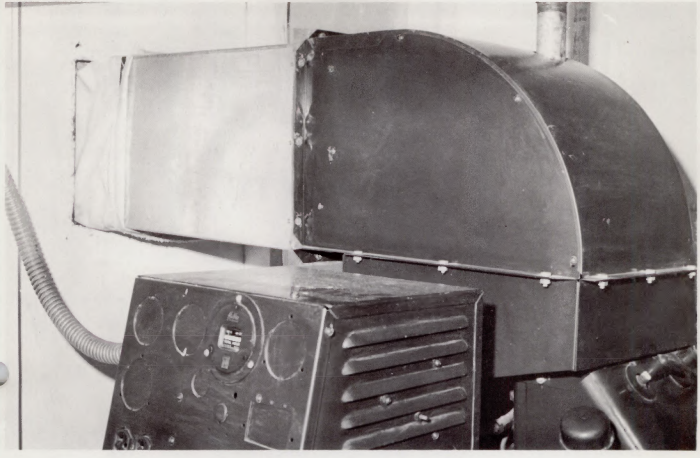
An installation and maintenance manual shall be furnished with each generator.

CRANKING LIMITER:

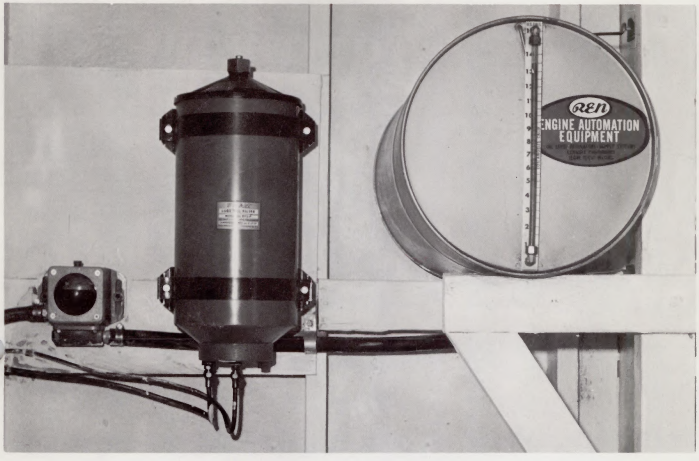
A cranking limiter shall be provided to protect the batteries and starting circuit. It will open the starting circuit in approximately 45 seconds if the plant has not started within that time. Locked-rotor protection shall open starting circuit immediately if engine will not crank.

USE:

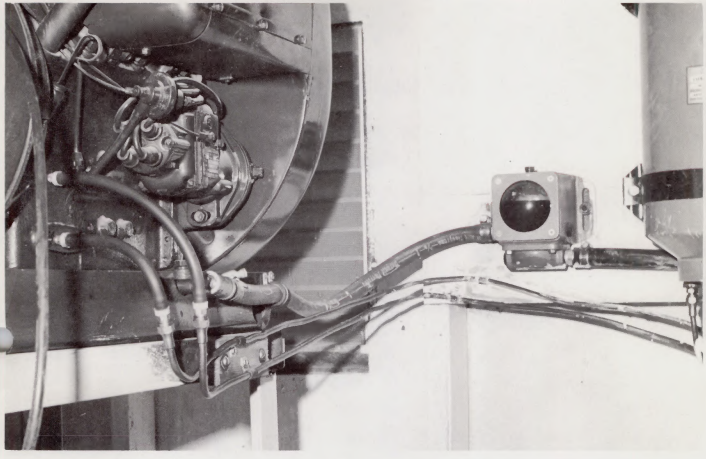
These generators are to be utilized as power source for deep well submersible pumps.



AIR EXHAUST TO OUTSIDE



FRAM OIL FILTER AND REN ENGINE
AUTOMATION EQUIPMENT STORAGE



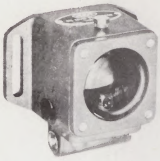
REN OIL LEVEL

Manufactured by POWER PLUS CORPORATION
4462 E. Washington Blvd. Los Angeles 23, California
Mid-Continent Distributor REN EQUIPMENT CO.
201 E. Stoner Shreveport, Louisiana
West Coast and Rocky Mountain Distributor NELSON-DUNN INC.
4450 E. Washington Blvd. Los Angeles 23, California

REN OIL LEVEL REGULATOR

MODEL RB

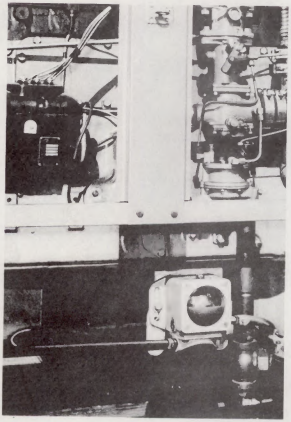
The REN Oil Level Regulator automatically maintains the correct oil level in the crankcase of internal combustion engines. From a separate supply tank at or near the engine, the Regulator delivers only that amount of oil required by the engine. Especially designed for application to engine crankcases, the REN Oil Level Regulator employs a ruggedly designed float valve which is insensitive to vibration. The unit is designed for universal application.



The Model RB REN Oil Level Regulator is intended for mounting on or adjacent to engine crankcases with the centerline of the window in the regulator adjusted to the same level as that to be maintained. The Model RB REN Oil Level Regulator is usually installed on the Model RK-2 pan mounting bracket which is bolted in place by using two of the engine oil pan bolts.

The universal mounting kit which includes pan mounting bracket, hose fittings and supply line hose is furnished. (See catalog sheet on Model RA REN Oil Level Regulator for direct adapter installations.)

REN OIL LEVEL REGULATOR MODEL RB FOR UNIVERSAL ENGINE APPLICATION



The Model RB REN Oil Level Regulator is frequently installed with a REN Slow-Flow Meter which accurately records the engine lubricating oil make-up requirements.

Provision is made for the installation of a pressure equalizing vent line when installing on engines which operate with a negative pressure in the crankcase or on engines which have a tendency to build up pressure in the crankcase.

Supply tanks and stands are available in 15, 30 and 55 gallon sizes. (See catalog pages on supply systems.)

The REN Oil Level Regulator body is a heavy aluminum casting. A quarter inch thick plexi-glass sight window is provided in the front of the casting to indicate visibly the accurate function of the regulator and to show the oil level. To insure the cleanliness of the oil to be delivered to the engine crankcase, a fine mesh screen and sediment bowl are used. Since the regulator valve is continually immersed in clean oil, wear and vibration considerations are eliminated.

Savings of up to 50% in oil consumption are proved by thousands of REN Oil Level Regulator installations. The REN Regulator eliminates the most costly phase in the operation of stationary engines; that of frequent manual filling and checking of crankcases. Protection is provided against damage frequently caused by manual filling of crankcases. Intervals between engine overhauls are frequently extended as much as 50%. In consideration of the above factors, the payout of the REN Oil Level Regulator is usually figured at less than one year.

GENERATOR ACCESSORIES

Miscellaneous items and cost - used by the Vale District:

1. Ren - Oil Level Regular — $68.00
   Model R.B.K. Complete with Installation Kit

2. Ren - 15 Gallon Tank With Calibrated Sight Gauge
   Model RS-1

ABOVE ITEMS AVAILABLE FROM

Nelson Dunn Inc.
4450 East Washington Street
Los Angeles, California

3. Filer, Oil - Fram Lube — $34.00
   Model F175-P

4. Switch, Main Disconnect — $ 3.75
   Make - Federal
   Catalogue #1370SN1

5. Breaker - Federal - 40 AMP — $ 6.00

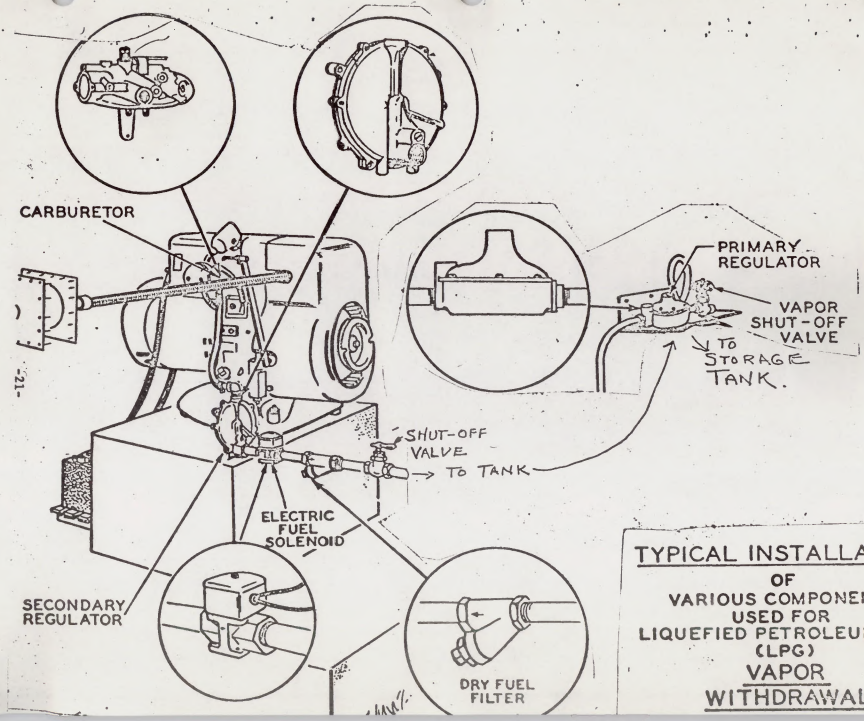
SWITCH AND BREAKER CAN BE PURCHASED FROM

Electrical Supply Houses

6. Delay-Relay and Receptable — $ 2.50
   Make - Ampente #115N0120

CAN BE PRUCHASED FROM ANY

Radio Supply House



TYPICAL INSTALLATION

OF

VARIOUS COMPONENTS

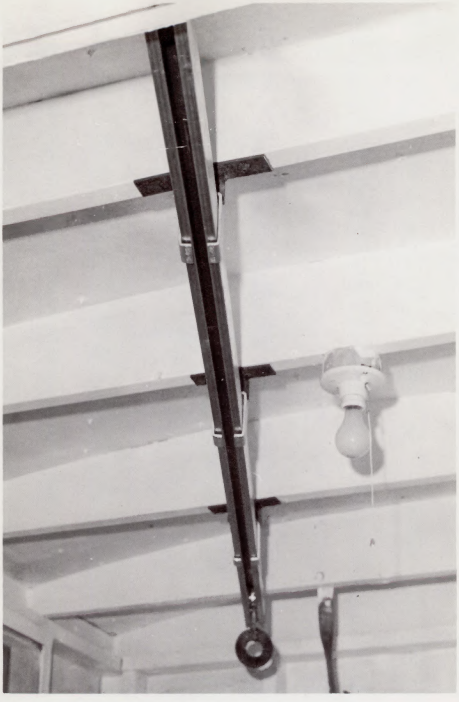
USED FOR

LIQUEFIED PETROLEUM GAS

(LPG)

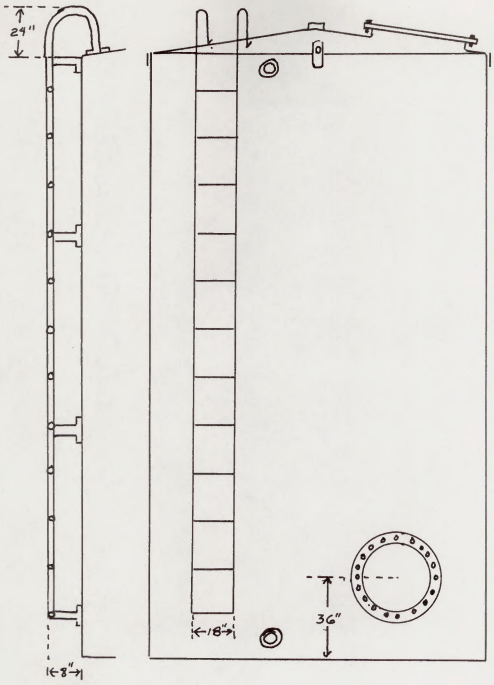
VAPOR

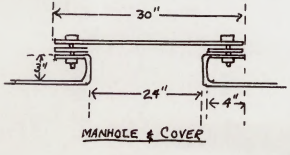
WITHDRAWAL



A TROLLY TRACK LAYOUT

This track mounted, diagnol, across and fastened to rafters is a heavy duty sliding door trolly with a single hanger and roller, converted, with a ring attached. This ring is for the purpose of a hoist to hang from and to lift the generator and move it to the doorway where it can be placed into a pickup body easily.





PUMP & WELL SYSTEM	
WATER TANK	
5/25/66	D.M.

CAPACITY OF WATER TANKS

	TANK CAPACITY (GALLONS)			
Gauge	5000	10,000	18,000	24,000
1	368	556	750	846
2	736			
3		1,668	2,250	2,538
4	1,473			
6	2,209	3,336	4,500	5,076
8	2,946			
9		5,004	6,750	7,614.27
10	3,682			
12	4,419	6,672	9,000	10,152
14	5,155			
15			11,250	12,691
18		10,000	13,500	15,229
21			15,750	17,767
24			18,000	20,310
Cost per tank	$480.00	$875.00	$1,286.00	Est. @ $1,800.00

SPECIFICATIONS

FOR

WATER STORAGE TANK

1. Tank, storage, water, vertical; constructed as follows and in accordance with the drawing attached. Dimensions and capacities are approximate.

18,000 Gallon

Cone height	12"	10 gauge steel
Tank height without cone	23'-9"	
Diameter of shell	11'-4"	3/16" steel
Diameter of tank		
Bottom plate	11"-6"	1/4" steel

10,000 Gallon

Cone height	10"	10 gauge steel
Tank height without cone	19'	
Diameter of shell	9'-6"	3/16" steel
Diameter of tank		
Bottom plate	9'-8"	1/4" steel

5,000 Gallon

Cone height	10"	10 gauge steel
Tank height without cone	14'	
Diameter of steel	7'-11"	10 gauge steel
Diameter of tank		
Bottom plate	8'	3/16" steel

2. Materials: All materials used in the fabrication of all items shall be new and of good commercial quality. With all carbon and weld spatter to be removed with a rotary type sander.

   Tank must be water tight.

3. Various Miscellaneous Specifications:

A. Manhole and cover

1. 24 inch diameter opening.
2. With cover - 3/8" steel plate 30" diameter.
3. Ring and support - 1/4 inch steel plate.
4. Gasket - 1/8" rubber.
5. Bolts and holes - 1/2" x 1½" galvanized M.B. on 3 inch centers.
6. Two manholes located on top and near the bottom approximately 36 inch above bottom.

B. Cone

1. To extend with the dimensions hereto before shown, with a pipe flange opening of 2 inches in center.

C. Pipe - Openings

1. All tappings indicated will be NPT welded pipe flanges in sizes indicated below.

2. Openings should be located on all tanks for use as desired.

Suggested as follows:

a. One in center of cone 2" for tank air vent.

b. One near top on side for inlet water line 2" diameter.

c. One near bottom on side for a drainage plug, 2" diameter.

d. An outlet approximately 6 inch above bottom on side for a water outlet for the pipe lines, 3 inch diameter.

D. Ladder

1. All steel construction with
2. Rungs, 3/4" x 18" round steel bars
3. Welded 18" apart to flat steel
4. Straps of 3/8" x 1¼" which
5. Begins at a point approximately 18" above bottom of tank, and
6. Extend 24" above top of tank as shown on tank and fastened back to tank.

7. Ladder to be fastened to side of tanks with brackets, 3/8" x 1¼" strap steel, allowing ladder to extend approximately 8" from tank.

E. Lift Lugs

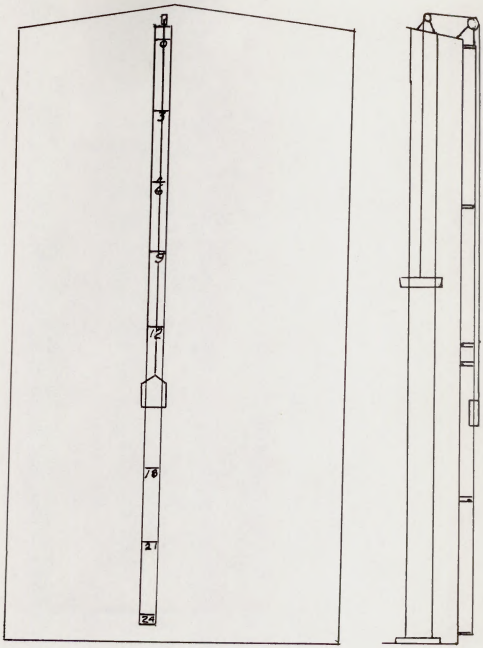
1. Number of 2 each, 1/2" x 3" x 10"
2. Solidly welded to top and sides
3. So as to allow tank be picked up by crane.

F. Paint

1. Interior of tank to be painted with a coat of tasteless and ordorless water resistant primer paint.

2. Exterior to be cleaned and primed with one coat of "Rustoleum" primer or equal.
3. Sides to be finished with a good grade of aluminum paint such a Quigleys Triple A. Paint discription shown at end of this section.

4. Bottom to be finished with a good coat of Quigleys Triple A No. 11 hydraulic black asphalt type of paint.



PUMP & WELL SYSTEM
GUAGE
WATER TANK
5/25/66 DM.

GUAGE

FOR A WATER TANK

This gauge is adaptable to each size of tank.

The gauge itself is made out of 1 x 8" fir S4S split into sections and bolted to tank to form a continuous run vertically to show the depth of water in the tank.

Painted white (enamel) with a brilliant color for the numerals which indicates the depth. A color should be used, and the size also should be large enough, for an aerial observer to see as he passes by in a plane.

Support brackets should be located top and bottom of each section and located not more than 6 foot apart.

Target and Float in tank should be balanced for them to work up and down in the water and rod respectively.

The target will be guided by two strands of galvanized smooth wire anchored to the top of the tank and bottom so as to let the float work up and down freely.

Pulleys, two sets, to be used on top of tank mounted on brackets so as to allow the float and target cable to roll free, up, over and down along gauge attached to the target.

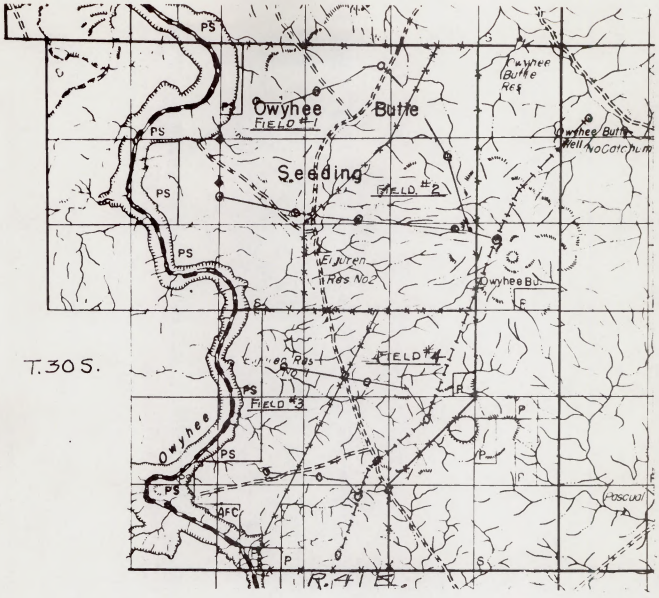
WATER STORAGE TANK

PRICES FOR VARIOUS SIZE TANKS AS FURNISHED ON AN OPEN END CONTRACT
FISCAL YEAR 1966

Item No.		Quantity	Unit	F.O.B. Vale, Oregon
1.	18,000 gal.	1-2	Each	$1,286.00
		3-6	Each	1,280.00
1b.	10,000 gal.	1-2	Each	875.00
		3-6	Each	872.00
1c.	5,000 gal.	1-2	Each	480.00
		3-6	Each	475.00
1d. Ladder, steel, mounted on tank if required per lin. ft.				$2.25
1e. Water level gauge, if required per tank				$75.00

CONTRACTOR

Steel Fabrication
% Don Rule
Route 3
Caldwell, Idaho
Phone: Middleton 585-2506



PUMP & WELL SYSTEM
TYPICAL INSTALLATION
5/25/66 D.M.

PIPELINES

We are using extensive pipe line systems in connection with our wells with fair to good result. Whenever you have mechanized type of equipment you will always have a certain amount of trouble. It is easier to study these lines out, survey what you will do and find out what you want first before you do it. Good planning will prevent and offset a lot of future trouble.

Our pipe lines consist of plastic tubing used as the pipe from the storage tank to the stock drinking trough of various sizes laid according to engineer plans.

Placing of the pipe in the ground represents a very important phase of the pipe line.

Mechanical trenches - digging a narrow trench to a depth when constant temperatures allow the plastic tubing to rest without too much movement from contraction and expansion and place on a good bed of loose earth and a good layer of earth free from rocks over it presents the best way of laying the plastic tubing.

The most economical laying of plastic tubing is achieved from use of a pipe layer. This pipe layer may be placed on a motor grader with an average penetration of not more than 18 to 20 inches. Or on a pull type of ripper with a penetration of 32 to 42 inches. This type of equipment may be built locally. Consists of placing the tubing into the ground through a curved pipe attached to a ripping tooth. The main thing with this type of equipment it should be used so as to pre-rip the trench once or twice or more times if needed, dependent on type of soil and how rocky an area may be.

The pipe line should always be designed by engineers. Never begin one without a complete engineering design. Grades are important, should be laid on a constant one whenever possible. Air locks should be prevented. Excessive head may develop easily enough due to the dropping of the water through considerable verticle distances. At the bursting points of limitation, relief for the line should be secured. Pressure relief points are to be located at the points of maximum pressure and not to exceed the maximum pressure recommended by the manufacturer. An inexpensive pressure tank may be installed, reloading the line at the correct pressure without any loss of water.

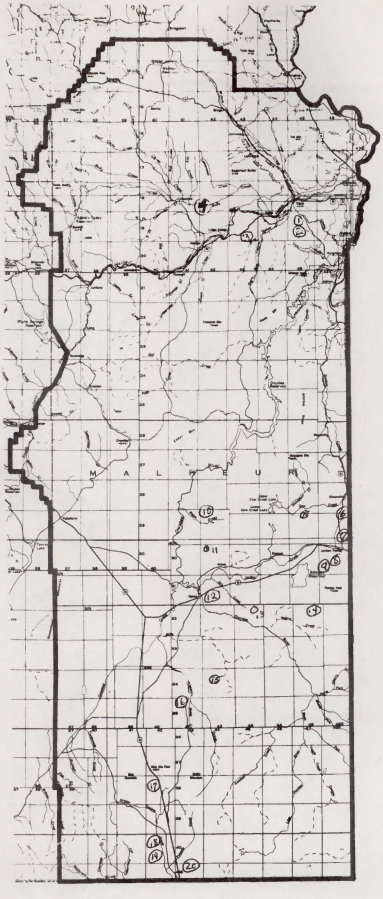
Basic information for designing a pipe line should include:

1. Location of proposed well.

2. The approximate area to be served.

3. The number of livestock to be served throughout a season of use.

Then the engineer should design an adequate plan and provide all data needed for the installation and use of the system.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VALE DISTRICT
WELLS

1.	North Harper Well	BLM Power
2.	Page Well	BLM Power
3.	Vines Hill Well	Com. Power
4.	Dahle Well	Com. Power
5.	Downey Canyon Well	BLM Power
6.	Hooker Creek Well	BLM Power
7.	Jordan Valley Well	BLM Power
8.	Soldier Creek Well	BLM Power
9.	Bricky Springs Well	BLM Power
10.	Bogus Creek Well	BLM Power
11.	Owyhee Butte Well	BLM Power
12.	Rome Well	BLM Power
13.	Monument Well	BLM Power
14.	Gluch Seeding Well	BLM Power
15.	Grafton Well	BLM Power
16.	Cherry Well	Jensen-Gas
17.	Blue Mountain Well	Com. Power
18.	McDermit Well No. 1	Com. Power
19.	McDermit Well No. 2	Com. Power
20.	Andy Fife Well	Com. Power

PUMP & WELL SYSTEM
LOCATION OF WELLS
VALE O-3
5/25/66 D.M.

APPENDIX

HELPFUL ITEMS

The following are miscellaneous items that mey be helpful to a planner or installer either way.

1. Pipe: Use of galvanized standard pipe as a riser pipe in a well.

   A. Always use a good grade of U. S. Standard Pipe, galvanized.

   B. Because of strength limitations of Schedule 40 pipe, the maximum setting of a pump allowed will be 600 feet. For deeper settings, the top portion of the riser pipe which exceeds 600 feet must be Schedule 80 galvanized pipe.

2. Check Valve: Use of

   A. If the pressure head against a pump check valve is 500 feet or less, no additional check valve is required.

   B. If the pressure head exceeds 500 feet a surface check valve must be used.

   C. If the pump setting exceeds 500 feet, an intermediate verticle check is to be installed at 500 feet above pump.

3. Screen:

   A. The elements of well completion include installing a well screen in a sand or gravel formation. The well screen supports the formation, prevents caving and permits water to enter the well, through closely spaced openings. The screens are made with openings of various sizes to fit the gradation of the water bearing sand.

   B. Various types are available namely:

      1. Drive well points.

      2. Continuous slot screen.

      3. Pipe base screen.

      4. Brass tubular screen.

QUIGLEY TRIPLE-A
INDUSTRIAL PAINT

This industrial paint combines the three essentials for a permanent protective covering for iron, steel and galvanized surfaces, concrete, stone, brick, cork insulation, etc. It is alkali-resistant, water-resistant, and acid-resistant.

Can be applied with either spray or brush. Will cover 300 to 400 sq.ft. per gallon on iron or steel. On concrete, stone, wood or brick, will cover about 100 sq.ft. first coat, and 200 or more sq.ft. the second coat. Dries by evaporation, only, not by oxidation, like oil paint and will not, therefore, crack, chip, or peel.

Triple-A Black No. 10 is recommended for metal, concrete, or other surfaces where protection is of sole importance and color decoration not necessary. Must not be mixed with other Triple-A colors and can not be used over newly painted surfaces. Is effective when applied to rust surfaces and improves adhesion where hot enamels are to be applied later.

All colors, except No's. 10 and 20 may be used on oil paint, etc., or paint may be applied over them.

No. 20 Heavy Duty is a long-life coating, for use under the most severe weather conditions, and is especially adapted for the most extreme corrosive conditions in mining, industrial and railroad equipment.

QUIGLEYS TRIPLE-A INDUSTRIAL PAINT

No's.	Color	Gallons Cans, each	5 Gallon Cans, each
10	Black	3.00	13.95
20	Heavy Duty Black	3.10	14.45
105	Gloss Black	3.10	-----
*111	Hydraulic Black	3.00	13.90
120	Green	7.00	-----
125	Red	7.00	-----
127	Fire Dep't. Red	7.30	35.20
128	Orange	7.30	-----
130	Gray	7.00	33.70
132	Blue	7.00	-----
140	Yellow	7.30	-----
145	White	7.00	-----
160	Dark Gray	7.00	-----

*Also recommended for surfaces where electric insulation is desired.

THINNER

No's.		Quart Cans	Gallon Cans	5 Gal. Cans
1	For No's. 10 and 20, each	$0.95	$2.50	$11.95
100	For No's. 105 to 380, each	.90	2.40	------

READY MIXED ALUMINUM COATINGS

No's.		Quart Cans	Gallon Cans	5 Gal. Cans
700	Interior, each	$1.35	$4.30	$-----
705	Exterior, each (S.L. Only)	1.40	4.35	20.95
715	Asphalt Base, each	----	----	-----

HEAT RESISTANT (AS ABOVE)

326	Exterior, 500 Deg. F., each	7.40
336	Exterior, 1,200 Deg. F., each	18.30

ZINC CHROMATE PRIMER

For both shop coat and field priming of metal of metal surfaces, and spot coating in the field. Produces a firm bond, dries rapidly and gives the necessary tooth for successive coats while preventing corrosive influences from attaching the underlying metal.

No's.		Gallon Cans	5 Gallon Cans
800	Yellow, each	$5.60	$-----
800R	Red, each	5.05	24.70

Cans in a case 4

Quigley's Triple-A Industrial Paint principle source is the Salt Lake Hardware Company - Boise, Idaho and Salt Lake City, Utah.

DETERMINING THE CAPACITY OF A PUMP

BY HORIZONTAL OPEN DISCHARGE METHOD

To estimate the pumping ce pecity of eny given unit, construct en L shaped measuring instru ment similer to that shown in the accompenying sketch. The shorter side should be 4" long. The longer side mey be eny convenient length merked in inches. With the water flowing from the horizontel open discherge, plece the long side of the L elong the top of the discherge pipe, ellowing the shorter side to heng downwerd es shown in the drewing. Slide the L elong the pipe until the 4" length barely touches the flow of weter. Note the distence ("X") treveled by the flow of weter before it drops 4". Presume, for exemple, thet the distence is 15" end the inside diemeter of the pipe (indiceted by "D") is 3". Consulting the teble below, find 15" in the column at extreme left heeded "Horizontel Dist. X (Inches)." Then move horizontelly to the right to the column showing the pipe diemeter being used (3"). The discherge rete is found to be 183 gellons per minute.

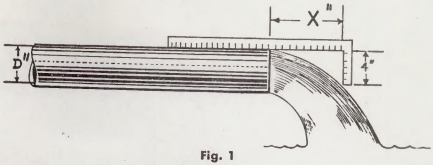


Fig. 1

Horiz. Dist. X (Inches)	DISCHARGE RATE (Gallons per minute) Nominal Pipe Diameter 1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"	8"	10"	12"	Average Velocity
4	5.7	9.8	13.3	22.0	31.3	48.5	83.5						2.1
5	7.1	12.2	16.6	27.5	39.0	61.0	104	163					2.6
6	8.5	14.7	20.0	33.0	47.0	73.0	125	195	285				3.1
7	10.0	17.1	23.2	38.5	55.0	85.0	146	228	334	580			3.7
8	11.3	19.6	26.5	44.0	62.5	97.5	166	260	380	665	1060		4.2
9	12.8	22.0	29.8	49.5	70.0	110	187	293	430	750	1190	1660	4.7
10	14.2	24.5	33.2	55.5	78.2	122	208	326	476	830	1330	1850	5.3
11	15.6	27.0	36.5	60.5	86.0	134	229	360	525	915	1460	2200	5.8
12	17.0	29.0	40.0	66.0	94.0	146	250	390	570	1000	1600	2220	6.2
13	18.5	31.5	43.0	71.5	102	158	270	425	620	1080	1730	2400	6.9
14	20.0	34.0	46.5	77.0	109	170	292	456	670	1160	1860	2590	7.4
15	21.3	36.3	50.0	82.5	117	183	312	490	710	1250	2000	2780	7.9
16	22.7	39.0	53.0	88.0	125	196	334	520	760	1330	2120	2960	8.4
17		41.5	56.5	93.0	133	207	355	550	810	1410	2260	3140	9.1
18			60.0	99.0	144	220	375	590	860	1500	2390	3330	9.7
19				110	148	232	395	620	910	1580	2520	3500	10.4
20					156	244	415	650	950	1660	2660	3700	10.6
21						256	435	685	1000	1750	2800		11.4
22							460	720	1050	1830	2920		11.8
23								750	1100	1910	3060		12.4
24									1140	2000	3200		13.0

For other then stenderd diemeter pipes the flow mey be determined by using the following formule:

Q gpm = X 1.28D² where D = Inside pipe diemeter

X = Horizontel open flow for drop of 4".

PROCEDURE IN DETERMINING DISTANCE TO WATER LEVEL

Install sufficient ⅛" or ¼" pipe (copper tubing mey elso be used) in the well so thet end of pipe extends 10 to 20 feet below lowest possible pumping level. Be sure thet all joints ere ebsolutely eir-tight by using white-leed or pipe compound. THE EXACT LENGTH OF PIPE OR TUBING IN THE WELL MUST BE KNOWN AND THIS INFORMATION SHOULD BE RECORDED.

Attech upper end of pipe or tubing securely et top of well. Connect e tire velve to the eir line et the top of the well and elso e pressure geuge. Next, connect e tire pump or other eir supply to the eir line end pump eir into the line until the pressure geuge reeches e meximum reeding. This reading is the point et which further supply of eir will not increese the reeding to eny higher velue. Record the geuge reeding.

Let X = Depth to weter (in feet) unknown

Y = Known length of eir line (in feet)

Z = Weter pressure on eir line, obteined from pressure geuge reeding. Altitude type geuge reeds directly in feet of weter. If geuge reeds in pounds convert to feet by multiplying by 2.31.

X = Y — Z

Distence to weter = length of eir line minus geuge reeding (feet).

EXAMPLE: Assume thet the eir pipe is 100 ft. long from center of geuge to bottom end of pipe end thet the highest reeding of the geuge needle is 15 lbs. = 15 × 2.31 = 34.6 feet.
Distence to weter = 100 — 34.6 = 65.4 feet.

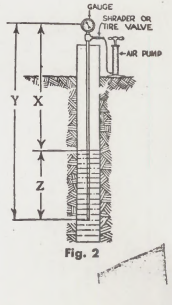
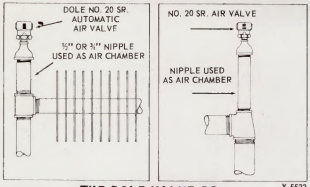


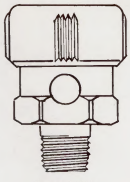
Fig. 2

SUGGESTED INSTALLATIONS



THE DOLE VALVE CO.
Plumbing & Heating Div.
Morton Grove, Ill.

INSTRUCTION SHEET



Dole No. 20 Sr. Automatic Hot Water Air Valve

Designed to perform three important functions

1. Manual Venting
2. Automatic Venting
3. Complete Shut-off

Part No. 2467217
and Pats Pending

THE DOLE VALVE COMPANY, MORTON GROVE, ILLINOIS

INSTALLATION

1. Drain Heating System (or follow your preferred procedure for installing Air Valves on Hot Water Heating Systems.)

2. Install on heating units.

3. When system is filled with air, such as when starting up a new job, or one that has been drained, fast air elimination can be had by venting manually.

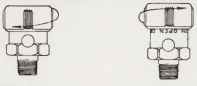
Dole No. 20 Sr. Air Valves can be installed on radiators, convectors, baseboard, mains and high points in the system.

They may be installed in any position except upside down.

They should be installed at a high point, where air can accumulate. It is necessary that provision be made to collect air that accumulates between venting cycles. Unless the vented member has an integral air accumulator, a nipple and fitting assembly can be used as an air chamber.

Dole No. 20 Sr. Air Valves are guaranteed against manufacturing defects for one year. This guarantee is limited to replacing defective valves. The Dole Valve Co. cannot assume any responsibility for water damage as a result of deterioration of valve parts due to chemical content of water, boiler compounds, cleansing agents or physical damage.

OPERATING INSTRUCTIONS



MANUAL SHUT-OFF POSITION

AUTOMATIC POSITION

1. Manual Shut-off:
   Merely close the valve by turning clockwise as far as it will go. In this position, the word "open" cannot be seen.

2. Automatic Venting:
   Set valve by turning selector dial counter-clockwise as far as it will go. In this position the word "Open" will be in view. The word "Open" is inverted so it can be more easily read from a position above the valve.

3. Manual Venting:
   Open valve by turning dial to position between shut-off and automatic positions.

KOHLER ELECTRIC PLANTS

SALES BULLETIN NO. 104-A

OCTOBER 1, 1961

MOTOR STARTING

Motor starting is an important consideration when making an electric plant load analysis. Variables, such as the type of motor and type of starting load must be known before a definite recommendation can be made.

The following maximum motor horsepower ratings will be helpful in recommending a proper size plant.

Size Plant	Max. Motor Horsepower
.5 KVA	Small shaded pole or series
1 KVA	1/4 H.P. capacitor
	1/8 H.P. split-phase
1.5 KVA	1/3 H.P. repulsion-induction
	1/4 H.P. capacitor
	1/4 H.P. split-phase
2 KVA, 2.5 KVA	1/2 H.P. capacitor
	3/4 H.P. repulsion-induction
3.5 KVA	2 H.P. repulsion-induction
5 KVA (single phase)	3 H.P. repulsion-induction
6.25 KVA (three phase)	3 H.P. induction
10 KVA (single phase)	5 H.P. repulsion-induction
12.5 KVA (three phase)	5 H.P. induction
15 KVA (single phase)	7-1/2 H.P. repulsion-induction
18.75 KVA (three phase)	7-1/2 H.P. induction
37.5 KVA (three phase)	10 H.P. induction
56.25 KVA (three phase)	15 H.P. induction
68.75 KVA (three phase)	25 H.P. induction
106.25 KVA (three phase)	30 H.P. induction
143.75 KVA (three phase)	40 H.P. induction

The above recommendations are on the basis of across the line starting of general purpose motors used with normal 50% voltage drop-out contactors.

In all motor starting situations, consideration should be given to the heavy starting current draw as well as the running current requirements. This data can be obtained from the motor nameplate.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
STANDARD - STARTING KVA OF MOTORS

Code letters adopted as a standard by N.E.M.A. are also helpful in determining the starting KVA of a particular motor.

The table lists the code letters and the multiplying factor applicable to the code letter. (Example: Code letter "F" on a 15 H.P. motor, the starting KVA would be 15x5.5 or 82.5 KVA.)

CODE LETTER	STARTING KVA PER H.P. *
A	0 - 3.15
B	3.15 - 3.55
C	3.55 - 4.0
D	4.0 - 4.5
E	4.5 - 5.0
F	5.0 - 5.6
G	5.6 - 6.3
H	6.3 - 7.1
J	7.1 - 8.0
K	8.0 - 9.0
L	9.0 - 10.0
M	10.0 - 11.2
N	11.2 - 12.5
P	12.5 - 14.0
R	14.0 - 16.0
S	16.0 - 18.0
T	18.0 - 20.0
U	20.0 - 22.4
V	22.4 - and up

* Starting KVA per horsepower range includes the lower figure up to, but not including, the higher figure. Example: 3.14 is designated by letter A, 3.15 by letter B.